Title: Understandable Autonomy for Unmanned Maritime Vehicles

Type of award: PhD Research Studentship

Department: Engineering

Scholarship Details: Scholarship covers full UK/EU (EU applicants who have been resident in the UK for 3 years prior to 1st September 2018) PhD tuition fees and a tax-free stipend at the current RCUK rate (£14,777 in 2018/19) plus an industrial top-up of £2,000 p.a. (subject to contracts)

Duration: 4 years

Eligibility: Home/EU

Starting Date: 17 September 2018

PhD Topic Background/Description

Maritime autonomous vehicles are a developing technology with applications including scientific, cargo and surveillance roles. Surface vessels must obey the collision regulations or COLREGS, long-established rules governing navigation, and future autonomous vessels are likely to inherit the same requirements. However, the COLREGS only refer to interactions between two vessels. This makes them easy for humans to understand, but sub-optimal in crowded shipping lanes.

More generally, recent European regulations grant individuals the right to explanation of any algorithmic decision “which produces legal effects concerning him or her or similarly significantly affects him or her”. Providing such explanations is more straightforward if an autonomous system’s decisions are based on human-understandable rules. This highlights the important trade-off between the performance of a system and the ease of understanding the rules governing its behaviour.

This PhD will investigate the effectiveness of human-understandable rules for autonomous vessel navigation, addressing the following questions:

• Can we implement COLREGS as a set of formal rules and then identify scenarios in which they perform badly or lead to collisions? What is the right language framework for these rules? Temporal logic? Fuzzy control? Something else?

• Can we identify the optimal decision policies for vessels? Or policies close to optimal? How close are they to the COLREGS?

• How does the performance loss vary with the number of vessels considered? For example, are rules for scenarios with three ships much better than pairwise rules? How does performance trade with ease of understanding?
The PhD will be based in the FARSCOPE CDT, giving a year of training at the start. The successful student will be part of the FARSCOPE cohort and work with Thales’ team developing real autonomous systems.

**Further Particulars**
[http://farscope.bris.ac.uk/](http://farscope.bris.ac.uk/)

**Candidate Requirements**
We are looking for an enthusiastic student with either a First or high 2:1 Honours degree in Engineering, Computer Science, Mathematics, Robotics or any other relevant subject.

Strong skills in mathematical and logical analysis, computer programming and numerical modelling are essential. Experience of AI, rule-based or fuzzy systems, or multi-agent systems (in maritime applications or any other domain) would be beneficial.

**Informal enquiries**
For informal enquiries please contact Prof Arthur Richards [arthur.richards@bristol.ac.uk](mailto:arthur.richards@bristol.ac.uk) or Prof Jonathan Lawry [J.Lawry@bristol.ac.uk](mailto:J.Lawry@bristol.ac.uk)

For general enquiries, please email [came-pgr@bristol.ac.uk](mailto:came-pgr@bristol.ac.uk)

**Application Details**
To apply for this studentship submit a PhD application using our [online application system](http://www.bristol.ac.uk/pg-howtoapply]

Applicants should select “PhD in Robotics and Autonomous Systems” as their programme and clearly indicate “Thales Maritime Autonomy Studentship” as their funding source in the Funding section.

Shortlisted candidates will be given a telephone interview in early May with the supervisors and industrial sponsor. There will also be an opportunity to visit for an interview in person if candidates are available.

**Apply now**